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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/805,720	03/22/2004	Hong-Jyh Li	2004 P 50201 US	9250
48154	7590	01/24/2006	EXAMINER	
SLATER & MATSIL LLP 17950 PRESTON ROAD SUITE 1000 DALLAS, TX 75252			KIM, SU C	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 01/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/805,720

Applicant(s)

LI, HONG-JYH

Examiner

Su C. Kim

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 November 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 11-38 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 33-38 is/are allowed.
- 6) ☒ Claim(s) 11-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### REMARK / ARGUMENT

By the amendment filed on 11/17/2005, claims 11-38 are pending. Previously claims 11-32 are rejected and claims 33-38 are allowed.

### DETAILED ACTION

#### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Forbes (US Pub 20040232422) in view of Tweet et al. (US 66997640).

1. Pertaining claim 11, Forbes discloses a method of fabricating a transistor, the method comprising:

providing a workpiece **310** , the workpiece having a top surface;

implanting germanium **304** into the top surface of the workpiece , and forming a second germanium-containing region **302A** beneath the first germanium-containing region, the first germanium-containing region extending a first depth beneath the workpiece top

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surface, the second germanium-containing region having a second depth extending below the first depth

depositing a gate dielectric material **832** over the first germanium-containing region; depositing a gate material **717** over the gate dielectric material;

patterning the gate material and gate dielectric material to form a gate and a gate dielectric over the first germanium-containing region; and

forming a source region and a drain region in at least the first germanium-containing region (**Fig. 7A**)

Forbes fails to teach the highest concentration of germanium is at the top surface of the workpiece with the concentration gradually decreasing as the distance from the top surface increases, said implanting further forming a first germanium-concentration region extending from the top surface of the workpiece and the first and second depth of germanium containing region comprising about 100 angstrom or less below the top surface of the workpiece;

Tweet discloses the highest concentration of germanium is at the top surface of the workpiece with the concentration gradually decreasing as the distance from the top surface increases, said implanting further forming a first germanium-concentration

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region extending from the top surface of the workpiece and the first and second depth of germanium contained region (**Column 2 lines 27-33**). In view of Tweet, it would have been obvious to one of ordinary skill in the art to incorporate the process step of Tweet into the Forbes because of improving "switching speed of nMOS and pMOS" (**Column 2 lines 63-64**)

Tweet also fails to teach the first and second depth of germanium containing region comprising about 100 angstrom or less below the top surface of the workpiece.

2. Pertaining to claim 14, Forbes fails to teach the third depth is about 120 A or less.
3. Pertaining to claim 15, Forbes fails to teach first depth is about 45 A or less, and the second depth is about 55 A or less.
4. Pertaining to claim 18 Forbes fails to teach the third depth is about 120 A or less.
5. Pertaining to claim 19, Forbes fails to teach the first depth is about 45 A or less, and the second depth is about 55 A or less.

6. Pertaining claim 24, Forbes fails to teach the step of implanting the germanium in to said first germanium-containing region comprising implanting a portion of said first germanium containing region with at least 80 % germanium.

7. Pertaining claim 25, Forbes fails to teach the step of implanting the germanium into said first germanium-containing region comprising implanting a portion of said first germanium containing region with substantially 100 % germanium.

8. Pertaining to claim 32, Forbes fails to teach forming the source and drain regions comprises a temperature of about 938.3 °C or less.

Given the teaching of the references, it would have been obvious to determine the optimum thickness, temperature as well as condition of delivery of the layers involved. See *In re Aller, Lacey and Hall* (10 USPQ 233-237) "It is not inventive to discover optimum or workable ranges by routine experimentation. Note that the specification contains no disclosure of either the critical nature of the claimed ranges or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. *In re Woodru* ; 919 f 2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Any differences in the claimed invention and the prior art may be expected to result in some differences in properties. The issue is whether the properties differ to

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such an extent that the difference is really unexpected. *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)

Appellants have the burden of explaining the data in any declaration they proffer as evidence of non-obviousness. *Ex parte Ishizake*, 24 USPQ2d 1621, 1624 (Bd. Pat. App. & Inter. 1992).

An Affidavit or declaration under 37 CFR 1.132 must compare the claimed subject matter with the closest prior art to be effective to rebut a prima facie case of obviousness. *In re Burckel*, 592 F.2d 1175, 201 USPQ 67 (CCPA 1979).

9. Pertaining claim 12, Forbes discloses the method according to claim 11, wherein forming the first germanium-containing region comprises forming an amorphous germanium-containing region **303A**, and wherein forming the second germanium-containing region comprises forming a first crystalline germanium containing region **302A (Fig 3B)**.

10. Pertaining claim 13, Forbes discloses the method according to Claim 12, further comprising annealing the workplace, before depositing the gate dielectric material, converting the amorphous germanium-containing region to a second crystalline germanium-containing region, the first crystalline germanium-containing region and the second crystalline germanium containing region comprising a single crystalline germanium-containing region, the single crystalline germanium-containing region comprising a 6 third depth beneath the workplace, top surface **(Fig. 12 paragraph [0054] Please note Forbes discloses a method to create a silicon region with a graded concentration of germanium ions by Nth germanium ion implantation)**.

11. Pertaining claims 16, Forbes discloses the method according to Claim 13, wherein annealing the workplace, comprises heating 2 the workplace, to a temperature of about 750 °C or less for about 60 minutes or less (**Paragraph [0035] lines 1-7 Forbes disclose as claimed**).

12. Pertaining claim 17, Forbes discloses the method according to Claim 12, further comprising annealing the workplace, after depositing the gate dielectric material **716**, converting the amorphous germanium-containing region to a second crystalline germanium-containing region, the first crystalline germanium-containing region and the second crystalline germanium-containing region comprising a single crystalline germanium-containing region, the single crystalline germanium-containing region comprising a third depth beneath the workplace, top surface(**Fig. 3A Please note Forbes discloses Ge ion is implanted before depositing the gate dielectric material**). It would have been obvious to one of ordinary skill in the art to incorporate the Ge implantation process after depositing gate dielectric material.

Changes in sequence or process steps are merely nothing more than a prima facie obvious in the absence of new or unexpected results.

See Ex parte Rubin, 128 USPQ 440 (Bd. App. 1959) (Prior art reference disclosing a process of making a laminated sheet wherein a base sheet is first coated with a metallic film and thereafter impregnated with a thermosetting material was held to



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render prima facie obvious claims directed to a process of making a laminated sheet by reversing the order of the prior art process steps.). See also *In re Burhans*, 154 F.2d 690, 69 USPQ 330 (CCPA 1946) (selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); *In re Gibson*, 39 F.2d 975, 5 USPQ 230 (CCPA 1930) (Selection of any order of mixing ingredients is prima facie obvious.).

13. Pertaining claim 20, Forbes discloses the method according to Claim 17, wherein annealing the workplace, comprises heating the workplace, to a temperature of about 750 °C or less for about 60 minutes or less (**Paragraph [0035] lines 1-7 Forbes disclose as claimed**).

14. Pertaining claim 21, Forbes discloses the method according to Claim 12, wherein implanting germanium into the top surface of the workplace, comprises forming a damage region (**Please note Ion implantation causes great structural damage to the target**) between the first germanium-containing region **303A** and the second germanium-containing region **302A**, further comprising annealing the workplace **300**, converting the amorphous germanium-containing region to a second crystalline germanium-containing region, the first crystalline germanium-containing region and the second crystalline germanium-containing region comprising a single crystalline germanium-containing region, and wherein annealing the workplace, causes the removal of the damaged region between the first germanium-containing region and the;

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second germanium-containing region (**Paragraph [0035] & 0054] Forbes disclose annealing process after Ge ion implantation & by the repeating process also forming nth SiGe layer and forming SiGe layers**).

15. Pertaining claim 29, Forbes discloses forming isolation regions in the workplace, before (**Paragraph [005] lines 12-13 Forbes called it “trench isolation region”**).

16. Pertaining claim 30, Forbes discloses the method according to Claim 11, further comprising forming spacers over sidewall of the gate and gate dielectric (**Fig. 7A**).

Claims 22- 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forbes (US Pub 20040232422) in view of Tweet et al. (US 66997640) and further in view of Park (US 6303450).

17. Pertaining claims 22-23, Forbes in view of Tweet fails to teach implanting the germanium at energy dose of about 5keV or less (**column 2 lines 56-57**) and a dose of about  $1 \times 10^{15}$  to  $1 \times 10^{17}$  atoms/cm<sup>2</sup> (**column 2 lines 43**). Park teaches implanting the germanium at energy dose of about 5keV or less and a dose of about  $1 \times 10^{15}$  to  $1 \times 10^{17}$  atoms/cm<sup>2</sup>. In view of Park, it would have been obvious to one of ordinary skill in the art to incorporate the implanting process step of Park into the Forbes because of “achieve higher surface concentration of Ge” (**Column 2 lines 56-57**)

Claims 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Forbes (US Pub 20040232422) in view of Tweet et al. (US 66997640) and further in view of Ko et al. (US Pub 20050035470).

18. Pertaining claim 26-28, Forbes in view of Tweet discloses the dielectric material. Forbes fails to teach specifying material. However, Ko teaches dielectric materials as silicon oxide, hafnium oxide etc. **(Paragraph [0027])**. In view of Ko, it would have been obvious to one of ordinary skill in the art to incorporate the dielectric material of Ko into the Forbes because a material having a relative permittivity greater than 5 **(Paragraph [0027])**

Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Forbes (20040232422) in view of Tweet et al. (US 66997640) and further in view of Yu (US 6528851).

19. Pertaining claim 31, Forbes in view of Tweet fails to disclose providing a silicon-on-insulator wafer (SOI). Yu teaches providing a silicon-on-insulator wafer (SOI). In view of Yu, it would have been obvious to one of ordinary skill in the art to incorporate SOI wafer into Forbes invention because "SOI wafer materials offer potential advantages over bulk materials for the fabrication of high performance integrated circuits" **(column 1 line 13-16)**.

***Allowable Subject Matter***

Claims 33-38 allowed over prior art.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Su C. Kim whose telephone number is (571) 272-5972. The examiner can normally be reached on Monday - Thursday, 9:00AM to 7:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Su C. Kim  
01/23/2006

A handwritten signature in black ink, appearing to read 'W. David Coleman', enclosed within a large, irregular oval loop.

**W. DAVID COLEMAN  
PRIMARY EXAMINER**